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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/524,325	09/01/2005	Rodney J Allam	34875	1156

21186 7590 02/01/2007
SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER

LEUNG, JENNIFER A

ART UNIT	PAPER NUMBER
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1764

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/01/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/524,325	Applicant(s) ALLAM ET AL.	
	Examiner Jennifer A. Leung	Art Unit 1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-29 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>10-24-06</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group II, claims 19-29, in the reply filed November 14, 2006 is acknowledged. The traversal is on the ground that the inventions of Group I and II are closely related. This is not found persuasive for the same reasons set forth in the restriction requirement. In addition, it is noted that the process for producing higher molecular weight hydrocarbon compounds or oxygenates is classified in class 518, subclass 702, whereas the apparatus is separately classified in class 422, subclass 189. The different classification, and hence, the different fields of search required for each of the inventions of Groups I and II, would cause a serious burden on the Examiner if the restriction were not required. The requirement is still deemed proper and therefore made FINAL. Group I, claims 1-18, is withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

2. In response to Applicant's request for clarification, no election of species is required.

Specification

3. The disclosure is objected to because of the following informalities:

On page 2 (first sentence of last paragraph) and on page 5 (second sentence of second paragraph), "USSN 10/083778" should be updated to reflect that the application is now abandoned. Appropriate correction is required.

4. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Drawings

5. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

6. Claims 26 and 29 are objected to because of the following informalities:

In claim 26, line 1: "Claim 19" should be changed to --Claim 20-- to correct for the lack of antecedent basis of "a second liquid methane wash column" (see lines 2-3), since it is noted that "a first liquid methane wash column" is set forth at claim 20, and not at claim 19.

In claim 26, line 2: a comma --,-- should be inserted after "liquid".

In claim 29, line 29: "FT" should be changed to --Fischer-Tropsch ("FT")--, in order to define the acronym FT.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

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such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 19, 20, 22-24, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79).

Regarding claims 19 and 20, Banquy (FIGs. 1-5) discloses an apparatus comprising: a syngas generation system (i.e., comprising a "primary steam reforming" zone and a "secondary oxygen reforming" zone; in detail in FIG. 2) generating syngas **11** by reaction of methane **2** with steam **5** and/or an oxidant comprising oxygen **8**, (see, for example, column 6, line 19 to column 9, line 3); a syngas conversion system (i.e., a "synthesis loop"; in detail in FIG. 3) converting syngas **11** into higher molecular weight hydrocarbon compounds or oxygenates **14** and producing an offgas **15**, (see, for example, column 9, lines 13-46); and a "physical separation" zone for separating the various components contained in the offgas **15** produced by the syngas conversion system.

Banquy discloses that "[a]ny physical separation process can be used" in the physical separation zone and, in particular, "[t]he physical separation can... be achieved by cryogenic techniques, or

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distillation at low temperature, such as outlined in Chemical Engineering Progress, February 1980, pages 72-79 ..." (see column 9, lines 55-68), to Davis et al.

Looking to the cited article, Davis et al. teaches a physical separation zone (Figure 2, showing the "methane wash approach") comprising a cryogenic separation system (i.e., a methane wash column) that produces a hydrogen product stream (i.e., in the overhead) and a first cryogenic liquid stream comprising unreacted CO (i.e., in the bottoms); and a cryogenic distillation column (i.e., CO/CH₄ fractionator) for separating unreacted carbon monoxide from the first cryogenic liquid stream to produce a separated CO product (i.e., in the overhead) and substantially carbon monoxide-free cryogenic liquid (i.e., in the bottoms); (see also page 74, beginning of column 2, to page 75, end of column 1).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the physical separation zone as taught by Davis et al. in the apparatus Banquy, on the basis of suitability for the intended use thereof, because any physical separation process can be used, and the physical separation process conducted in the physical separation zone of Davis et al. is specifically suggested as being suitable for use in the apparatus, according to Banquy, above.

Regarding claim 22, Banquy discloses (see column 9, lines 47-54, with emphasis added),

"The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and *a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.*"

Therefore, it would have been obvious for one of ordinary skill in the art at the time the

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invention was made to provide a conduit means for feeding separated carbon monoxide product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the separated carbon monoxide product (i.e., the carbon oxides from the residual gas stream) to be recycled as fuel to the primary steam reformer, as specifically suggested by Banquy, above.

Regarding claim 23, Banquy further discloses that the residual gas stream contains argon (see column 9, lines 46-54). Thus, the modified apparatus of Banquy inherently comprises a conduit means for removing an argon-enriched stream from a location in the region of high argon concentration in the cryogenic distillation column (i.e., via the bottoms conduit of the CO/CH₄ fractionator to the fuel discharge line, since argon is a higher boiling component relative to the lower boiling component of carbon monoxide; see FIG. 2 of Davis et al.).

Regarding claim 24, Banquy discloses (see column 9, lines 47-54, with emphasis added),

“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and *a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.*”

Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a conduit means for feeding separated methane product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the

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methane product (i.e., methane from the residual gas stream) to be recycled as fuel to the primary steam reformer, as specifically suggested by Banquy, above.

Regarding claim 28, as best understood, Banquy (FIG. 2) discloses that the syngas generation system comprises a partial oxidation reactor (i.e., a secondary oxygen reformer **R**; column 7, lines 3-42) and an enhanced heat transfer reformer (i.e., an endothermic primary steam reforming reactor **F**, having catalyst containing reforming tubes heated externally by burners; see column 6, lines 43-64).

Regarding claim 29, Banquy discloses that the syngas conversion system comprises at least one FT reactor (i.e., a synthesis converter **SC**, for reacting hydrogen with carbon monoxide, carbon dioxide or mixtures of these carbon oxides, a.k.a. Fischer-Tropsch synthesis, to yield methanol), (see FIG. 3; see column 9, lines 4-46).

8. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79), as applied to claim 19 above, and further in view of Ireland et al. (US 4,044,063).

The collective teaching of Banquy and Davis et al. is silent as to the apparatus further comprising a hydrogenation system.

Ireland et al. (FIG. 1; see, for example, column 8, line 15 to column 9, line 3) teaches a hydrogenation system (e.g., hydrotreating unit **56**; or hydrodewaxing unit **62**) for hydrogenating a fraction of the higher molecular weight hydrocarbon compounds **54**, **60** produced by a syngas conversion system (i.e., in F-T synthesis zone **4**). It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a hydrogenation

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system to the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the provision of a hydrogenation system helps maximize the production of further liquid hydrocarbon products from the Fischer-Tropsch reaction products stream, as taught by Ireland et al.

9. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79), as applied to claim 19 above, and further in view of Keller (US 4,650,814).

Banquy discloses that "[a]ny physical separation process can be used" in the physical separation zone and, in particular, "[a]nother physical separation for this purpose is the membrane separation process, which is described in Hydrocarbon Processing May 1980 pages 115-118, and July 1980 pages 65-67," (column 9, lines 55-68). The collective teaching of Banquy and Davis et al., however, is silent as to the provision of a membrane separation system, for removing helium from the separated hydrogen product.

Keller (FIG. 3) teaches a membrane separation system 325 for removing inert gases 344 such as helium (see column 7, lines 6-17) from a separated hydrogen product stream 330. (see column 13, line 10 to column 14, line 34; see column 15, lines 10-36; see also FIG. 1, column 8, line 14 to column 9, line 8). It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a membrane separation system in the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the membrane separation system enables the generation of a high purity hydrogen stream for use as a recycle, while minimizing the amount of inert compound build-up in the system by separating

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and removing any inert gases, such as helium, from the system, as taught by Keller.

10. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79), as applied to claim 19 above, and further in view of Martin (US 4,102,659).

Regarding claim 26, the collective teaching of Banquy and Davis et al. is silent as to the provision of a second liquid methane wash column.

Martin (FIG. 1; column 7, line 49 to column 9, line 64) teaches the provision of a second liquid methane wash column (i.e., a second absorption zone **19**), to be located between a cryogenic separation system (i.e., a first liquid methane wash column defined by a first absorption zone **15**) and a cryogenic distillation column (i.e., a fractionation zone **27**), wherein the second liquid methane wash column **19** separates unreacted hydrogen from the cryogenic liquid to produce a separated hydrogen fuel by-product (i.e., residual H₂ in line **88**) and a second cryogenic liquid comprising unreacted carbon monoxide (i.e., the liquid in line **21**), to be fed to the cryogenic distillation column **27**. It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a second liquid methane wash column between the cryogenic separation system/first methane wash column and the cryogenic distillation column in the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the second methane wash column achieves a substantial and unexpected improvement in recovery of high purity carbon monoxide relative to the prior art processes used for such separation, as taught by Martin (see, for example, column 5, lines 31-42).

Regarding claim 27, Banquy (see column 9, lines 47-54, with emphasis added) discloses,

“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.”

As seen in FIGs. 1, 4 and 5, the apparatus further comprises conduit means 12 for removing a portion of the separated hydrogen product, in order to recycle the hydrogen to the syngas conversion system (i.e., the synthesis loop) for generation of higher molecular weight hydrocarbon compounds or oxygenates 14. Please note that the recitation of a particular molar concentration of helium within the separated hydrogen product stream is considered a process limitation that adds no further patentable weight to the apparatus claim.

Conclusion

11. Haag et al. and Pinto, which were cited as documents of particular relevance in the International Search Report for PCT/GB03/03403, have been fully considered by the Examiner but they have not been relied upon, in light of the newly found prior art references cited above.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

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Jennifer A. Leung
January 30, 2007